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Subject: Monthly Report - December 1982

From/Location: E. L. Cambridge

To/Location: J. G. Kaufman

RAW MATERIALS & CHEMICALS RESEARCH

Alumina Evaluation

The problem of low results in our attrition test apparatus has been resolved. Comparison of our results with those of Alcoa and Columbia Falls is shown below:

	<u>Tucson</u>	<u>Alcoa</u>	<u>C.F.</u>
Alpart	42	39.5	42
Kwinana	8	9	8
Reynolds	31	26	21

The Alpart result, as previously concluded, is unacceptably high.

Low-Soda Alumina

A literature search on sodium removal from metallurgical process streams has been received and potentially interesting abstracts identified. Based on analysis of the ATH and limited solubility data for the $\text{AlCl}_3/\text{HCl}/\text{NaCl}/\text{H}_2\text{O}$ system it appears that a relatively large bleed stream might be required. Experimental work on the rate of impurity build up in the ATH/HCl sparging process has been begun and the first round of samples submitted for analyses. This will allow an initial look at mass balances on impurities in the ATH - ACH conversion step. Sufficient ACH is being made to do calcination work for analytical samples and some preliminary grinding tests. Equipment is now in hand for the green and fired density tests.

Water leach of ATH at 100°C for 24 hours does not significantly reduce the Na_2O level. Two hours at 200°C in a pressure bomb reduces the level from 0.3 to 0.07 percent. From visual inspection, it does not appear that water washing significantly alters the color properties of Alpart ATH. Therefore, the HCl process is likely to be the preferred method for production of a low-soda product.

The marketing study from C. H. Kline & Company verifies our initial assumptions concerning market size, prices, growth rates, and concludes that this is an excellent opportunity for ARCO Metals. The opportunity is particularly enhanced by the recently announced plans for Reynolds to withdraw from the business in mid-1983 with the closing of their Hurricane Creek plant in Arkansas.

A report summarizing this work is scheduled for January 15, 1983. I would recommend a presentation to the Executive Planning Committee early in the new year.

AD-120 Process

A. Feedstock Preparation

The METSIM simulation to produce PCACH is now complete and has been forwarded to the Process Evaluation group to size equipment for the new cost study.

B. Tests at Alcoa Labs

Alcoa have now completed several tests with our materials that we provided. At this time the following conclusions can be drawn.

1. Our material is extremely reactive (MTC approximately 40).
2. Addition of salts is not required to catalyze the reaction to achieve this high mass transfer number.
3. The spent-bed material remains substantially amorphous with no build-up of unreactive species.
4. Off-gas analysis confirms the low carbon consumption of approximately 0.4 lb/lb.
5. Our materials give a reduction of about 40 percent in total CxCly compared to Alcoa's but the absolute level averaged about 1100 ppm, which is unacceptably high.

With the exception of the PCB results, Alcoa's tests confirm a process performance superior to our claims. The coke pretreatment does, however, reduce PCB formation and other approaches are now underway to try to achieve an acceptable level of ≤ 50 ppm.

C. Other

The following reports were issued:

Report No. 82-TP-9, "Technical and Economic Evaluation of the Alcoa Smelting Process" by E. L. Cambridge.

Report No. 82-TP-14, "AD-120 Process - Progress Report No. 2, Economic Evaluation and Sensitivity Analysis" by S. K. Das, R. O. Loutfy, and P. J. Cameron.

METALS PRODUCTION RESEARCH

AD-116 Potlining Resource Recovery

A draft patent application was received from the attorney. Necessary changes were made and an execution copy is being prepared for filing.

AD-108 Composite Anode Process

Experiments with a composite anode confirm that an all chloride electrolyte can be used without electrochemical evolution of chlorine for any feasible commercial operating condition. This provides the possibility of developing a low cost electrolyte with compositions dictated only by vapor pressure considerations.

The possibility of further depolarizing the composite anode with sulphide ions to lower the decomposition voltage below the theoretical value of 1.33 was investigated. Sodium sulfide was used as a source of sulfide ions in this experiment, however, aluminum sulfide is the preferred source. Preliminary results showed that (1) cell voltage extrapolated to zero current was 1.3 without sulfide and 0.95 in the presence of sulfide, (the theoretical voltage at zero current for a sulfide depolarized reaction is 0.98), indicating that, within experimental error, sulfide depolarization was achieved. (2) The composite anode voltage at 4.6 asi was 180 mv lower in the presence of the sulfide, which is within 52% of the theoretical value expected.

These results among others to date, could provide the foundation for a patent position around the basic process patent.

DEVELOPMENT & TECHNICAL SERVICES

Cell Temperature Sensor

The materials for the semi-enclosed crucible for the testing of cryolite-resistant materials arrived this week. An extended 200-hour test will begin next week.

Construction of a vertical hot plate to simulate a typical pot shell under varying conditions is complete. It will be used to test the reproducibility and correlation of the heat flow sensor patented by Alcoa. Work on the test should begin next week. One sensor has been sent to Columbia Falls for their evaluation.

IITRI's proposal for laser glazing of Si_3N_4 should be received by the first of next year.

Sebree Large Anode

The large anode cells continue to operate well. Current efficiency of the cells is about the same as the plant (approximately 93%). With no aggressive attempts to reduce cell voltages, a 0.06 kwh/lb reduction in power consumption has been observed. Earlier problems encountered with setting anodes has been reduced with better setting practices of the crews.

In Tucson, resistivity and apparent density measurements of regular and large anodes were completed last week. An analysis of this data will be issued to Sebree by the end of the month.

Columbia Falls Cell Magnetics

Pot 304 continues to operate with a higher than desired metal pad of 17 to 18 inches. The pot is being overtapped and the metal pad level is expected to decrease slowly. The ledge is slightly extended, but does not appear to be a problem and is being watched closely. The second magnetically compensated pot was converted last week in line 3 (pot 516).

PERSONNEL

- o Sandra Erkes was hired as a Technician in the Metal Production group, effective December 27, 1982.
- o S. K. Das and D. S. Moran attended a week-long course on "Economic Evaluation and Investment Decision Making" held locally by Professor Stermule.


E. L. CAMBRIDGE

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